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A BRIEF REPORT OF THE BARBERRY ERADICATION CAMPAIGN IN SOUTH DAKOTA, 1925

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Introduction

Barberry eradication has been in progress for nearly eight years in South Dakota. It is a part of the general campaign, started in 1918, to reduce stem-rust losses of small grains by eradicating all harmful varieties of barberries from the north-central wheat-growing States of the upper Mississippi Valley. The campaign in this State is conducted cooperatively by the U. S. Department of Agriculture, the South Dakota State College, and the State Department of Agriculture. The Conference for the Prevention of Grain Rust, Minneapolis, Minn., composed of representatives of agricultural and allied interests and a number of State and local organizations, cooperates closely with the work.

In addition to the actual surveys for common barberry bushes the campaign consists of educational activities, stem-rust epidemiology studies, and eradication methods.

The various surveys for barberries are classed as (1) the original or preliminary survey, (2) the second survey, and (3) resurvey.

The original or preliminary survey is a property-to-property survey in cities, towns, and villages and a farm-to-farm survey of all rural properties in the State.

A second survey is one in which every rural and city property covered on the original survey is again searched for barberries. This second inspection is made of every foot of properties upon which barberry bushes may possibly be growing. The second survey is absolutely essential to insure that every planted and escaped harmful barberry bush in the State is located.

Resurvey is a reinspection of the properties on which barberries have been found and eradicated. Such a resurvey is necessary to insure that every barberry bush has been eradicated completely and to remove any sprouts or seedlings that may have appeared after the first removal.

In addition to these surveys for barberries, stem-rust surveys are made during the growing season. Stem-rust surveys consist of inspections of grains and grasses over the entire State during the growing season, for the purpose of noting the development of stem rust in various sections of the State. Tracing the severity of the stem-rust attack serves as a valuable means of locating missed barberry bushes.

Progress of the Campaign during 1925

The original or first survey of South Dakota was completed at the close of the field season in 1924. Over 58,000 barberry bushes and nearly 26,000 seedlings were found on this survey. With this preliminary survey of the State completed, practically all of 1925 was spent in second survey, only so much resurvey and stem-rust survey being done as seemed necessary. Approximately $10\frac{1}{2}$ counties were covered by a thorough property-to-property survey in 1925. A total of 446 bushes, of which 138 were escaped bushes and 285 were seedlings, was found on 66 different properties in this survey. This makes an average of 42.4 bushes and 27.1 barberry seedlings on 6.28 properties per county. These results indicate the necessity of a second survey in order to locate and destroy every barberry bush.

The largest single finding of barberries in 1925 was on a farm in Deuel County, on the NW $\frac{1}{4}$ of section 26, Brandt Township. The original hedge of about 50 bushes was heavily fruited and a good many berries had been spread from them before they were destroyed. Barberry seedlings undoubtedly will appear at this place for several years.

Why Second Survey Is Necessary

There are several reasons why this second survey is necessary in many of the counties in South Dakota.

1. Many barberries were cut off or improperly dug by property owners as a result of early publicity in the campaign. These were missed on the first survey, because field men were not told of these locations. After a year these cut-off bushes produced sprouts which are capable of harboring stem rust.

2. Some escaped barberry bushes and seedlings could not be found on the first survey because they were so small. Since the first survey, new seedlings have developed from seeds which did not germinate for several years. These barberries soon became large enough to cause serious damage.

3. Some bushes were planted or had grown from seeds in unusual places and were not found on the first survey. A thorough second survey will find and eradicate most of these.

It is very essential that the second survey be conducted before the sprouts and small bushes become large enough to bear seeds.

Resurvey Essential for Complete Eradication

Resurvey in 1925 was carried on in connection with second survey. Properties on which barberries had been found previously were carefully inspected for new sprouts and seedlings. This is an efficient method of resurvey, since travel is made for the purpose of second survey. However, some resurvey is necessary each year aside from that in connection with second survey.

Areas of escaped barberries need inspection each year to locate and destroy the seedling barberries that appear. Evidence in this State shows that seeds may lie dormant for seven years and then produce a new plant. This means that resurveys are necessary for at least seven years after the fruiting bushes have been destroyed.

These resurveys include a careful inspection of all properties near the original planting of barberries. In Moody County, barberry seeds were scattered by birds and other animals from the fruiting bushes to 11 nearby farms. Over 100 similar instances of the spread of barberries have been found in South Dakota. More than 45,000 escaped barberry bushes and seedlings have been found and destroyed in this State.

Chemical Eradication of Barberries

Barberries are difficult to kill because of their hardiness and spreading root system. Digging or cutting them off usually will not kill them. Results of the campaign show that they will sprout again in about 85 per cent of the cases when these methods of eradication are employed. Because of this difficulty, experiments were made by the U. S. Department of Agriculture to find a cheap and efficient method of killing barberries. Nearly 40 chemicals were used in these experiments. Crushed rock salt and kerosene proved to be the most satisfactory. Salt is the more convenient to handle and is very effective. A barberry with a diameter of 12 inches at the base will be killed by an application of 10 to 15 pounds of crushed rock salt over the crown. The salt must completely cover the crown of the bush to insure its death. A gallon of kerosene will kill a similar-sized bush. However, kerosene is much slower in its action. The knowledge of these chemicals as killing agents has greatly reduced the time and money necessary to insure complete destruction of barberry bushes.

Other Activities in Barberry Eradication

Educational work has preceded or accompanied the various surveys for barberries. It is essential that people over the State become familiar with the project if the best results are to be obtained. Educational work has been carried on through lesson plans for schools and colleges, demonstrations at fairs and other gatherings, public talks, radio talks, circular letters, circulars, and posters. Education of the entire public is a slow process. However, the results of educational activities are now becoming evident. People in general are familiar with the project and are much more in favor of it than they were at the beginning of the campaign.

Studies on the epidemiology of stem rust are carried on every year in an attempt to solve some of the problems of control of black stem rust. These include studies of the spread of stem rust from barberries to susceptible grains and grasses, the possibility of stem-rust epidemics from infection blown into the State, and the possibility of overwintering of the red stage of stem rust in South Dakota and its return to small grains and grasses without the aid of the common barberry. All the information obtained in these studies to date indicates that the common barberry is the main, and probably the only, source of stem rust in South Dakota.

The Stem Rust Situation in 1925

Stem rust again was destructive in certain counties in South Dakota in 1925. It did not do so much damage as in many years past, but it was discouragingly destructive in some areas.

Naturally many people have asked where this rust came from. In South Dakota there are two sources of stem rust. The first and most important is the common barberry on which the rust gets its start in the spring, and the second, spores of the red stage of stem rust which have blown into the State. Spores are known to have traveled great distances with the wind, and it may be that some of the spores responsible for the stem rust in the past year blew in from outside the State. However, over 1,000 barberries were found in all surveys in South Dakota in 1925. Undoubtedly many more bushes are still present and will be found in the near future.

A single barberry bush may do considerable damage during a growing season. Research has shown that a mid-sized barberry bush is capable of producing about 64 billions of stem-rust spores. Thus with 1,000 barberry bushes remaining, each capable of producing so many spores, it is no wonder that this State suffered some loss from stem rust in 1925. However, this year's loss is small when compared with that of 1916, before the 125,000 barberry bushes were destroyed in this State. In that year an estimated stem-rust loss of 64 per cent occurred. Weather conditions were highly favorable for the development of stem rust in both of these years; in fact, general conditions were similar in the two years. This apparent decrease in the general loss of small grains by stem rust is substantiated by positive evidence in many areas that the removal of barberry bushes has noticeably decreased and in many instances eliminated stem-rust losses.

Other States Eradicate Barberries

In addition to South Dakota, 12 other States are eradicating barberries. More barberries have been found in some of these States than in South Dakota. However, there is no State in which barberry eradication is of more importance. Fall-sown grains in the winter-grain States allow an earlier harvest, and this tends to minimize stem-rust losses. In the great spring-grain area of North Dakota, Minnesota, and South Dakota, harvests are relatively late and the stem rust started by the barberry bushes has a longer time in which to reproduce itself and to destroy the crops.

The following table shows, by States, the number of barberry bushes, sprouting bushes, and seedlings found in each State in the barberry eradication area. This table also gives the totals for each State and the grand totals for the 13 States.

Barberry bushes found in eradication campaign, 1918-1925

State	Bushes	Sprouting Bushes	Seedlings	Total
Colorado	24,434	6,882	3,456	34,772
Illinois	328,956	15,151	1,741,538	2,085,645
Indiana	196,395	19,585	12,106	228,086
Iowa	793,847	21,636	49,564	865,047
Michigan	481,700	2,904	1,544,273	2,028,877
Minnesota	785,956	49,388	48,336	883,680
Montana	11,293	5,171	4,771	21,235
Nebraska	95,516	15,846	11,873	123,235
North Dakota	22,414	1,684	157	24,255
Ohio	292,142	17,942	530,836	840,920
South Dakota	59,811	42,989	26,608	129,408
Wisconsin	3,404,253	90,902	1,335,367	4,830,522
Wyoming	4,176	575	53	4,804
Total	6,500,893	290,655	5,308,938	12,100,486

The attached map, "Properties Having Barberry Bushes, 1918-1925," shows the approximate location of the barberry bushes which have been found in South Dakota. The map entitled "Numbers of Barberry Bushes and Seedlings Found, 1918-1925" shows the number of bushes found in each county in the State.

Present Status of the Campaign in South Dakota

1. Original survey of the entire State was completed at the close of the field season in 1924. This included a first property-to-property survey of every county in the State.

2. A total of 129,408 barberry bushes, sprouting bushes, and seedlings has been found and destroyed on 1,112 properties in South Dakota since the campaign was started in 1918. This number includes 59,811 bushes, of which 20,878 were escaped, 42,989 sprouting bushes, and 26,608 seedlings.

3. A second property-to-property survey has been completed in 19.5 counties in eastern South Dakota, comprising an area of 16,456 square miles. (See map, "Properties on which Barberry Bushes Were Found in Second Survey, 1918-1925.")

4. Barberries were found on 122 properties, aggregating 1,531 bushes and 685 seedlings, on the second property-to-property survey. These bushes were missed on the first survey. (See map, "Properties on which Barberry Bushes were Found in Second Survey, 1918-1925.")

5. Resurveys of properties on which barberries were found are necessary until the property is positively cleared of bushes. A total of 42,989 sprouting bushes and 9,065 seedlings was found on 671 different properties on resurveys.

6. By the use of chemicals in killing barberry bushes, the sprouting-bush problem has been largely solved, but new seedlings are found each year on properties which formerly had fruiting bushes.

7. Many instances have been noted in the State in which black stem rust has been found to spread from infected barberries. The removal of these bushes decreases the severity of the infection in these localities. In many instances barberry bushes have been found because of the stem rust which they had spread to nearby grasses and grains. Additional evidence of stem-rust losses caused by barberries has been obtained through the testimonials of farmers who lived near the guilty bushes.

8. Educational and publicity work is helping to clear away the skepticism which was manifested early in the campaign relative to the merits of the project.

9. The year 1925 was unfortunate for the work because of the presence of some black stem rust. However, in spite of the weather favorable for rust development, South Dakota suffered an estimated loss of only 10 per cent to wheat. In 1916 under similar weather conditions it was estimated there was a 64 per cent loss to wheat in this State.

10. Public sentiment in the areas covered by a second survey is more favorable toward the work than it was on the first survey.

Conclusion

The harmful barberry is the only plant known to spread the spring stage of black stem rust. The removal of all common barberries from the barberry-eradication area will eliminate the most important source of stem-rust infection. Investigations made by the U. S. Department of Agriculture show that red spores of stem rust seldom, if ever, live over winter in the barberry-eradication area. This means that stem rust must either start its growth on the barberry every spring in this area or be blown into the State from outside sources. However, rust from outside sources usually arrives too late to cause much damage. Investigations have shown that the earliest and most severe epidemics of stem rust in South Dakota have been traceable to local barberries. The complete eradication of barberries in several communities in South Dakota has resulted in a most noticeable decrease in the amount of stem rust in each of these localities.

Definite control of stem rust in these 13 States can not be expected until all barberry bushes in the entire area are found and destroyed. This is a tremendous task. Stem-rust control can not be expected in a period of a few years. Time and continuous effort are necessary.

It is of the utmost importance that every person in South Dakota be able to recognize the common barberry. It is also his duty to report the location of all harmful barberries to the State College of Agriculture or the U. S. Department of Agriculture. Thorough eradication is essential to the success of the campaign. It can be accomplished only through the co-operation of the citizens of the State.
